United States
Environmental Protection
Agency

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Systems Laboratory
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September 1989

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Research and Development

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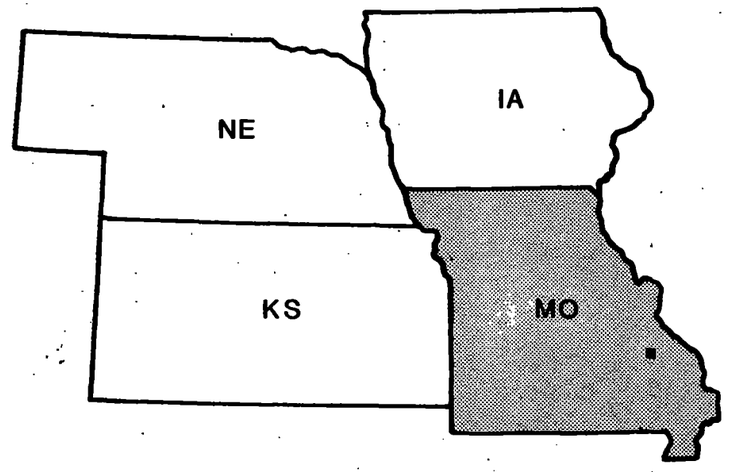
AERIAL PHOTOGRAPHIC ANALYSIS OF THE MADISON MINE COMPLEX

Fredericktown, Missouri

EPA Region 7



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AERIAL PHOTOGRAPHIC ANALYSIS OF THE MADISON MINE COMPLEX

Fredericktown, Missouri

by

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Contract No. 68-03-3245

Project Officer

C. E. Lake
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Environmental Monitoring Systems Laboratory
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ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89193-3478

NOTICE

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ABSTRACT

This report presents an aerial photographic analysis of the Madison Mining Complex that occupies approximately 650 acres on the southeast side of Fredericktown, in the northeastern portion of Madison County, Missouri. Six years of black-and-white, one year of color infrared, and one year of conventional color aerial photography acquired over a 51-year period (1939-1989) were used to perform the analysis which was conducted to monitor physical conditions and activities that may have led to the contamination of the surrounding environment.

The 1939 photography showed solid waste dumped adjacent to an intermittent stream. The photo coverage of 1955 revealed expanded operational activities at the site, and stained drainage patterns from mining buildings passing through tailings. The 1964 photography showed erosion of the tailings, signs of previously released and escaped liquids entering the drainage system from the site, and seepage from the southern tailings. The mining activity was no longer operational on the 1971 photo. The tanks had been removed and most structures destroyed. Seepage and erosion was still visible at the tailings and signs of escaped liquids from the eastern ponds were noted. On the 1974 photography the southern tailings, which had seepage and erosion along its face, was also flooded. The cleared area north of the site contained a possible disposal trench. The 1981 photo showed new buildings and drainage ditch, and extensive modifications to the face of the southern tailings; also, three new trenches in the cleared area north of the site. The 1984 photo showed three new ponds along the drainage ditch leading northeast from the site. Two of the trenches at the north of the site had been filled and two more excavated. All of the trenches were filled prior to the 1989 coverage which showed the area being expanded to the east, and revegetation activity. The impoundments previously located at the north end of the site had been filled and the area where two ponds were located on the eastern side of the site was barren with many small rills and gullies passing through.

The U.S. Environmental Protection Agency's Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, prepared this report for the Agency's Region 7 Environmental Services Division in Kansas City, Missouri and the Office of Emergency and Remedial Response in Washington D.C.

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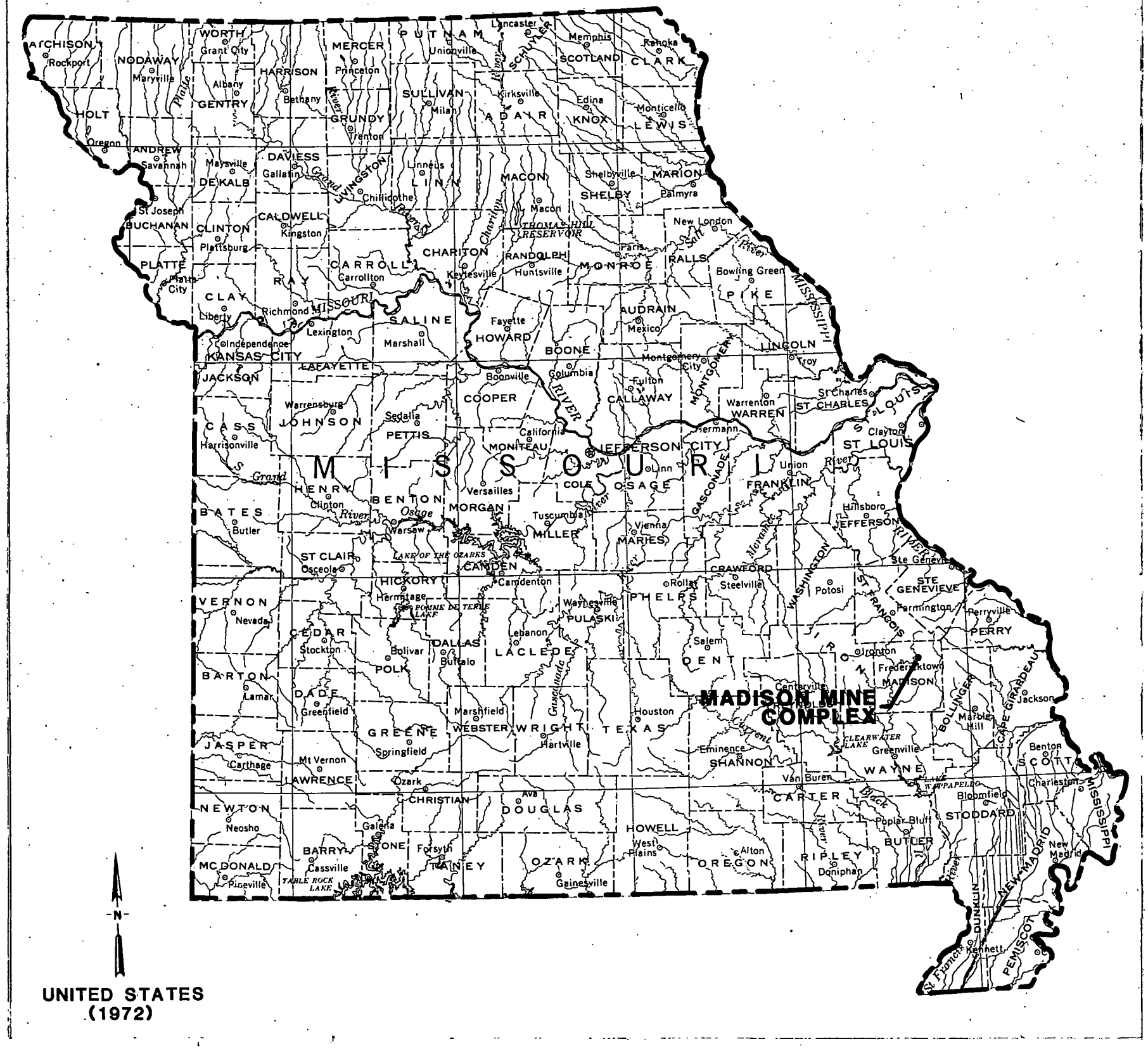

Figure 1. Site location map, Missouri. Scale 1:2,500,000.

INTRODUCTION

This report presents an aerial photographic analysis of the Madison Mining Complex. This facility occupies approximately 650 acres southeast of Fredericktown in the northeast portion of Madison County, Missouri (Figures 1 and 2). Six years of historical black-and-white, one year of color infrared, and one year of current conventional color aerial photography (Table 1) acquired over a 51-year period (1939-1989) were used to perform the analysis. This analysis was conducted to monitor activities and physical conditions that may have led to the contamination of the surrounding environment.

The U.S. Environmental Protection Agency's Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, prepared this report for the Agency's Region 7 Environmental Services Division in Kansas City, Missouri and the Office of Emergency and Remedial Response in Washington D.C.

METHODOLOGY

Stereoscopic pairs of current and historical aerial photographs are used to perform the analysis. Stereo viewing enhances the interpretation because it allows the analyst to observe the vertical as well as horizontal spatial relationships of natural and cultural features. Stereoscopy is also an aid in distinguishing between various shapes, tones, textures, and colors that can be found within the study area.

Evidence of waste burial is a prime consideration when conducting a hazardous waste analysis. Leachate or seepage resulting from burial and dumping of hazardous materials might threaten existing surface or ground-water sources. Pools of unexplained liquid are routinely noted because they can indicate seepage from buried wastes that may enter drainage channels and allow contaminants to move off the site. An excellent indicator of how well hazardous materials are being handled at a site is the presence or absence of spills, spill stains, and vegetation damage. Trees and other forms of vegetation that exhibit a marked color difference from surrounding members of the same species are labeled "dead," "stressed," or "damaged" based upon the degree of noticeable variation. Vegetation is so labeled only after consideration of the season in which the photographs were acquired.

The U.S. Environmental Protection Agency's Statement of Procedures on Floodplain Management and Wetlands Protection (Executive Orders 11988 and 11990, respectively) requires EPA to determine if removal or remedial actions at hazardous waste sites will affect wetlands or floodplains and to avoid or minimize adverse impacts on those areas. To aid in compliance with these orders, significant wetland areas located within and adjacent to the sites have been identified and delineated. However, the sites have not been visited to verify the accuracy of wetland identification.

Drainage analysis determines the direction a spill or surface runoff would follow. Direction of drainage is determined from analysis of the photographs and from U.S. Geological Survey topographic maps. Whenever they are available, 7.5-minute quadrangle maps (scale 1:24,000) are used to show site location and to provide geographic and topographic information.

Results of the analysis are shown on annotated overlays attached to the photos. The following table provides documentation of the photographs used in this report:

TABLE 1. DOCUMENTATION OF AERIAL PHOTOGRAPHY

Site name, SSID, location, and geographic coordinates	Figures	Date of acquisition	Original scale	Film type†	Photo source‡	Photo I.D.	Frames
Madison Mine	3	03-02-39	1:21,300	B&W	NARS	BLQ-4	24
Fredericktown, MO	4	08-26-55	1:21,300	B&W	ASCS	BLQ	12
37°33'02"N	5	10-10-64	1:21,300	B&W	ASCS	BLQ	201
090°16'38"W	6	05-14-71	1:20,100	B&W	ASCS	BLQ	129
SSID# Unknown	7	04-17-74	1:33,200	B&W	EROS	VDKL	141
	8	09-28-81	1:43,400	B&W	ASCS	29123	64
	9	04-18-84	1:58,000	CIR	ASCS	NHAP-82	171
	10-12	05-02-89	1:6,000	CC	EMSL	89790	2,4,6

†Film type identification:

B&W: Black-and-White Panchromatic

CIR: Color Infrared

CC: Conventional Color

‡Photo source identification:

NARS: National Archives and Records Service, Cartographic Branch; Washington, D.C.

ASCS: U.S. Department of Agriculture, Agricultural Stabilization and Conservation Service, Salt Lake City, Utah.

EROS: U.S. Department of the Interior, Geological Survey, Earth Resources Observation Systems Data center, Sioux Falls, South Dakota.

EMSL: U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

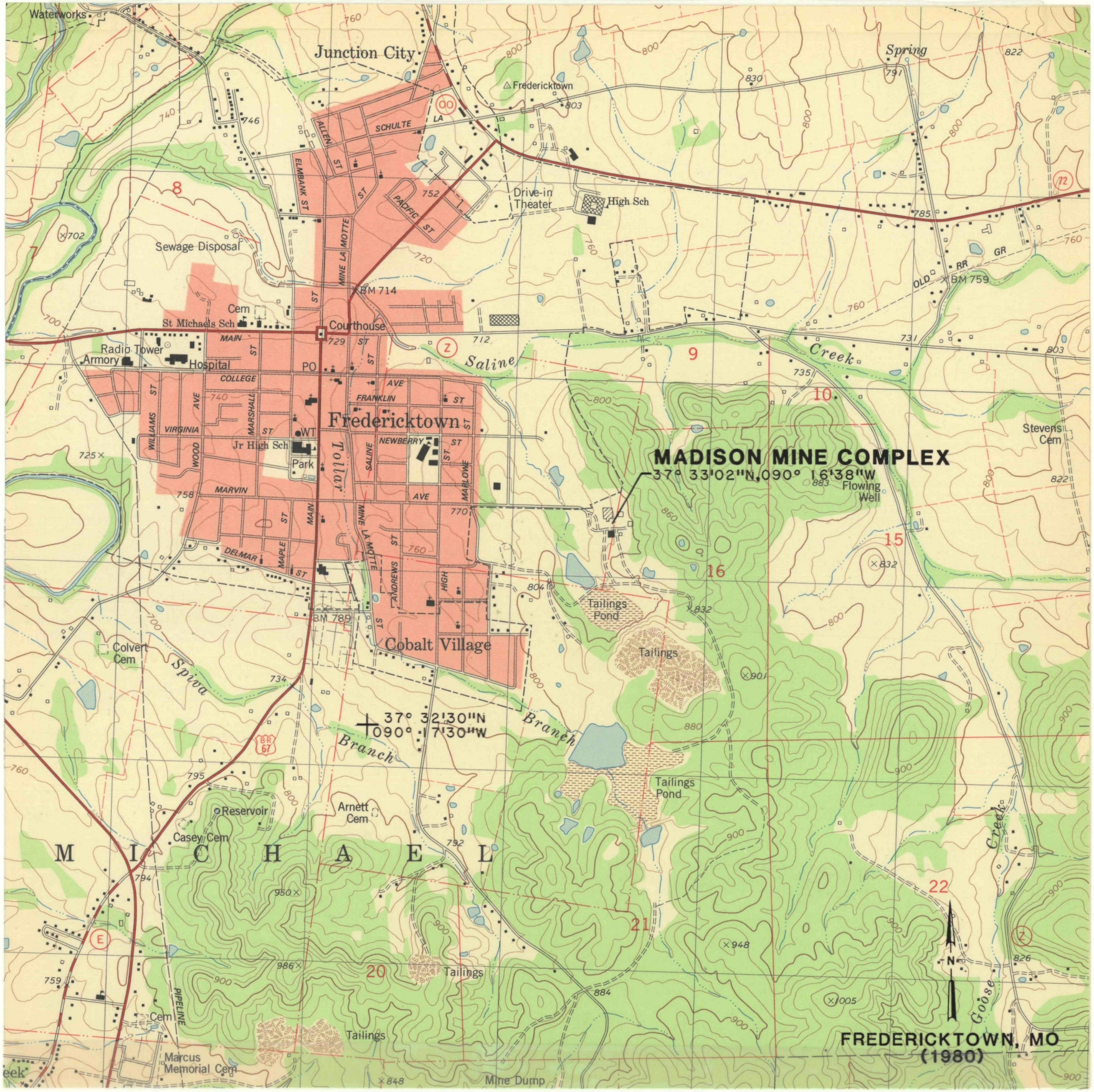

Figure 2. Local site location map, Fredericktown, Missouri. Scale 1:24,000.

ANALYSIS SUMMARY

The Madison Mine complex is located approximately 70 miles south of St. Louis in the northeast portion of Madison County, on the southeast side of Fredericktown, Missouri. The site is situated in a portion of the natural drainage system from the foothills surrounding the southeastern portion of Fredericktown. All runoff from these hills, including a 100-year flood, would pass through the tailings carrying portions off site in a northerly direction to Saline Creek. This complex occupies approximately 650 acres that has no visible security. The first photographic coverage (1939) showed the site to consist of an ore processing area, mine tailings, tailings pond, and two small impoundments. Solid waste was being dumped along the intermittent stream leading from the mine north to Saline Creek. The photo coverage of 1955 showed a great expansion of the mining operation at this site with the construction of a new mill works area, extensive new tailings, as well as new ponds and impoundments. The stained drainage pattern showed liquid from buildings had passed through the tailings and entered the tailings pond. The 1964 photo coverage showed extensive erosion was occurring along the face of the largest tailings pile. The drainage ditch from the mill works emptied directly into the stream leading to Saline creek and into a new impoundment that showed signs of previous releases into the stream. The two ponds on the east side of the site both showed signs of escaped liquids that may have entered drainage leaving the site. Along the face of the southern tailings were visible signs of seepage and erosion which extended into Tollar Branch. The mining operation no longer appeared active on the 1971 photography as a majority of the buildings had been demolished and all the tanks had been removed from the mill works where staining was noted. Once again there was signs of escaped liquid from the pond on the east side of the site, and continued erosion and seepage along the face of the southern tailings pile. The photo coverage of 1974 showed little change at the Madison Mine. Two diversionary ditches had been dug uphill of the ponds in the east portion of the site. The water had been intentionally released from the dam south of the southern tailings pile and had flooded the tailings. Seepage and continued erosion were still visible on the face of these tailings. There was a possible disposal trench located at the south end of

the cleared area north of the site. The 1981 photography displayed renewed activity at the site with the construction of new buildings, a drainage ditch, and extensive modification to the face of the southern tailings. A new mine entrance and pond were located approximately one-half mile east of the site. Three new trenches were located in the cleared area north of the site and the trench previously located in this area had been filled. The 1984 photo showed continued erosion along the face of the northern tailings pile, and the work on the face of the southern tailings was completed. A series of three small ponds had been built at the end of the eastern drainage ditch. Two of the trenches in the clearing north of the site had been filled and two new trenches excavated. All the trenches located in this cleared area were filled prior to the 1989 overflight, the southern portion of the area revegetated, and disposal activity had expanded to the east. The impoundments previously located at the north end of the site had been filled. Small rills and gullies now pass through the area previously occupied by two ponds on the east side of the site. Extensive erosion is still visible on the northern tailings pile.

PHOTO ANALYSIS

MARCH 2, 1939 (FIGURE 3)

This photo shows the Madison Mine to be located southeast of Fredericktown, which is located in the northeast portion of Madison County, approximately 70 miles south of St. Louis, Missouri. The site, which is both road and rail served, has no visible security. There are tailings and a tailings pond located in the drainage pattern on the south and southwest side of the ore processing buildings. Annotation 1 is the release point where excess liquid is allowed to flow from the tailings into the tailings pond. Annotation 2 is an overflow ditch that directs excess liquid from the tailings pond into an unnamed intermittent stream that leads directly to Saline Creek. There are two small impoundments located immediately north of the tailings pond that are designed to retain runoff from the ore processing area. Immediately north of the impoundments at Annotation 3 solid waste is being dumped along the unnamed stream.

INTERPRETATION CODE

BOUNDARIES AND LIMITS

- FENCED SITE BOUNDARY
- UNFENCED SITE BOUNDARY
- FENCE
- STUDY AREA

DRAINAGE

- DRAINAGE
- FLOW DIRECTION
- INDETERMINATE DRAINAGE

TRANSPORTATION/UTILITY

- VEHICLE ACCESS
- RAILWAY

SITE FEATURES

- DIKE
- STANDING LIQUID
- SL STANDING LIQUID
- EXCAVATION, PIT (EXTENSIVE)
- MOUNDED MATERIAL (EXTENSIVE)
- MM MOUNDED MATERIAL (SMALL)
- CR CRATES/BOXES
- DR DRUMS
- HT HORIZONTAL TANK
- PT PRESSURE TANK
- VT VERTICAL TANK
- CA CLEARED AREA
- DG DISTURBED GROUND
- FL FILL
- IM IMPOUNDMENT
- LG LAGOON
- OF OUTFALL
- SD SLUDGE
- ST STAIN
- SW SOLID WASTE
- TR TRENCH
- VS VEGETATION STRESS
- WD WASTE DISPOSAL AREA
- WL WETLAND

Figure 3. Madison Mine, March 2, 1939. Approximate scale 1:21,300.

AUGUST 26, 1955 (FIGURE 4)

Extensive changes have occurred at the Madison Mine since the photo coverage of March 2, 1939, including the presence of new ponds, impoundments, tailings, and an additional ore processing area. Some of the older facilities have been demolished.

There are no signs of the solid waste previously located at Annotation 3. This area is now level and barren. The only change to the tailings pond at Annotation 4 is the build-up of sediment at its south end where liquid from the tailings of Annotation 5 are released into the pond. The stained drainage pattern atop the tailings of Annotation 5 shows that liquid coming from the buildings at the end of the rail line is traveling into the pond at Annotation 4. The new tailings at Annotation 6 has a pipeline extending along its northeastern and northwestern edges that originates in the building at the end of the rail line. The new mill works that has been constructed at Annotation 7 has four vertical tanks that are uncontained and one that is contained. There is a small drainage ditch along the northern edge of this area that leads to a new impoundment at Annotation 8. Annotation 9 is a new pond that appears to be lined. The new unlined ponds located at Annotations 10 and 11 are both filled to capacity; Annotation 10 with sludge and Annotation 11 with a dark colored liquid. There has been no visible change to the pond at Annotation 12. An earthen dam has been built across the drainage into Tollar Branch creating the impoundment at Annotation 13. A drainage ditch (Annotation 14) is being excavated from the north end of this area and leading into the tailings at Annotation 5. There is a cleared area along the side of the hills south of the impoundment that leads to another earthen dam under construction. Annotation 15 is the location of a small group of newly erected buildings, and Annotation 16 is the new access road to the Madison Mine complex.

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Figure 4. Madison Mine, August 26, 1955. Approximate scale 1:21,300.

OCTOBER 10, 1964 (FIGURE 5)

The quantity of sediment at the south end of the tailings pond (Annotation 4) has increased, and appears to be the result of runoff passing through the tailings of Annotation 5. The build-up at the east end of the tailings (Annotation 5) appears to be the accumulation of erosion that is occurring along the face of the tailings located at Annotation 6. The drainage ditch leading from the mill works of Annotation 7 now passes around the south side of the impoundment at Annotation 8, which is filled with sludge, and enters the stream leading to Saline Creek. This ditch forks at the railroad tracks and the northern fork leads to a new impoundment at Annotation 18. There is a visible trail of previous releases from the northern corner of this impoundment that leads into the stream leading to Saline Creek. Most of the sludge previously located in the pond at Annotation 10 has been removed. There is a trail leading from this pond's northern edge that appears to be the track of previously released liquid which traveled to the stream that leads to Saline Creek. The southwestern wall of the pond at Annotation 11 appears to have been breached and temporary repairs made. There are piles of what appears to be sludge all along the southwestern walls of the ponds at Annotations 10 and 11, and there is a trail of staining leading from the breach area, through the tailings of Annotation 5 to the tailings pond at Annotation 4. The staining also enters the drainage system leaving the site. The earthen dam has been completed at the south end of the tailings located at Annotation 13. A drainage ditch has been dug from the western edge of this dam, around the south side of the tailings to Tollar Branch. Along the face of these tailings are located an area of seepage (Annotation 19) and an area of erosion (Annotation 20). Both of these areas lead directly to Tollar Branch. The drainage ditch (Annotation 14), leading from the face of the tailings to the tailings at Annotation 5, has been completed. Annotation 21 is an area previously occupied by small impoundments where a small amount of solid waste dumping has occurred.

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Figure 5. Madison Mine, October 10, 1964. Approximate scale 1:21,300.

MAY 14, 1971 (FIGURE 6)

All of the buildings at the Madison Mine complex except those located at Annotation 7, have been demolished. All of the tanks have been removed from the area of Annotation 7, and there is visible staining at the south end of the largest building in this area. The impoundments located at Annotations 8 and 18 appear unchanged, as do the tailings pond and tailings of Annotations 4, 5, and 6. There is a breach in the wall of the pond at Annotation 11 and a trail showing the ponds contents traveled through the tailings of Annotation 5 to the tailings pond of Annotation 4. Along the face of the tailings (Annotation 13) are still located an area of seepage at Annotation 19 and an area of erosion at Annotation 20. The area between the erosion activity and Tollar Branch is now barren.

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Figure 6. Madison Mine, May 14, 1971. Approximate scale 1:20,100.

APRIL 17, 1974 (FIGURE 7)

There has been very little change at the Madison Mine complex since the photo coverage of May 14, 1971 (Figure 6). The erosional activity along the face of the mine tailings of Annotation 6 has continued to fill the tailings of Annotation 5 that releases excess liquids into the tailings pond (Annotation 4). A majority of the sludge previously located in the impoundment at Annotation 8 is no longer visible. The impoundment located at Annotation 18 is partially filled with liquid that may have come from the mill works area (Annotation 7) via the drainage ditch. To the east of this impoundment at Annotation 23 is located a trench that is possibly being used for waste disposal. Fill material is being dumped into the north end of the pond located at Annotation 10. The breach in the southern wall of the pond at Annotation 11 has again been temporarily repaired, and there is mounded material inside the pond adjacent to a pit that has been excavated adjacent to the repaired breach. A diversionary ditch has been excavated on the uphill side of both ponds to direct runoff around the ponds and into the drainage system leading to Saline Creek. A majority of the tailings at Annotation 13 are submerged by water, previously held by the earthen dam at the south end of the tailings. An intentional cut appears to have been made in the dam allowing all the water to escape. The seepage is still visible on the face of these tailings at Annotation 19, and the erosion activity at Annotation 20 has spread.

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Figure 7. Madison Mine, April 17, 1974. Approximate scale 1:33,200.

SEPTEMBER 28, 1981 (FIGURE 8)

The impoundments located at Annotations 8 and 18 and the pond at Annotation 10 have the same basic appearance as shown on the photo coverage of April 17, 1974 (Figure 7). There is now a second breach in the southern containment wall of the pond located at Annotation 11. There is a trail left by the liquid released through this breach that travels through the tailings of Annotation 5 to the entrance of the tailings pond at Annotation 4. The erosion activity has continued along the face of the tailings at Annotation 6 where there are now many deep gullies. There has been a new group of four buildings constructed on a small knoll at Annotation 25, and a discharge pipe coming from underground empties into the newly constructed drainage ditch (Annotation 26) which empties into the natural drainage system leading northeast to Saline Creek. Extensive modifications are in progress on the face of the tailings located at Annotation 13. The earthen dam at Annotation 22 has been repaired and there are pieces of heavy equipment located at Annotation 24. Annotation 27 is a mine entrance and an empty pond that are directly linked to the site by dirt roads leading from the mine entrance to ponds at Annotations 10 and 11, and the newly constructed buildings at Annotation 25. There are three trenches located in the area of Annotation 28 and the trench previously reported at Annotation 23 has been filled. The disturbed ground in the southern portion of this area indicates more trenches may have been previously located here.

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Figure 8. Madison Mine, September 28, 1981. Approximate scale 1:43,400.

APRIL 18, 1984 (FIGURE 9)

There were no significant changes observed since the photo coverage of September 28, 1981 (Figure 8) at tailings pond (Annotation 4), tailings (Annotation 5), impoundments (Annotations 8 and 18) or the mine and pond at Annotation 27 in the Madison Mine complex. The erosion activity along the face of the tailings at Annotation 6 is continuing to enlarge the gullies. The breaches in the southern wall of the pond at Annotation 11 have been repaired and both ponds at Annotations 10 and 11 are filled with dark colored liquid. The work around the tailings at Annotation 13 has been completed. The earthen dam, previously located at Annotation 22, has been removed and a small dike created to the immediate south. A new drainage ditch that empties into Tollar Branch has been excavated along the southern edge of the tailings (Annotation 29). The drainage ditch at Annotation 26 has been extended to the north where it empties into a series of three newly created ponds (Annotations 30, 31, and 32) before releasing into the natural drainage system leading to Saline Creek. In the cleared area of Annotation 28 the previously reported two northern trenches have been filled and paralleling trenches excavated. There is an excavation near the southern trench that contains an unidentified dark colored substance.

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TRANSPORTATION/UTILITY

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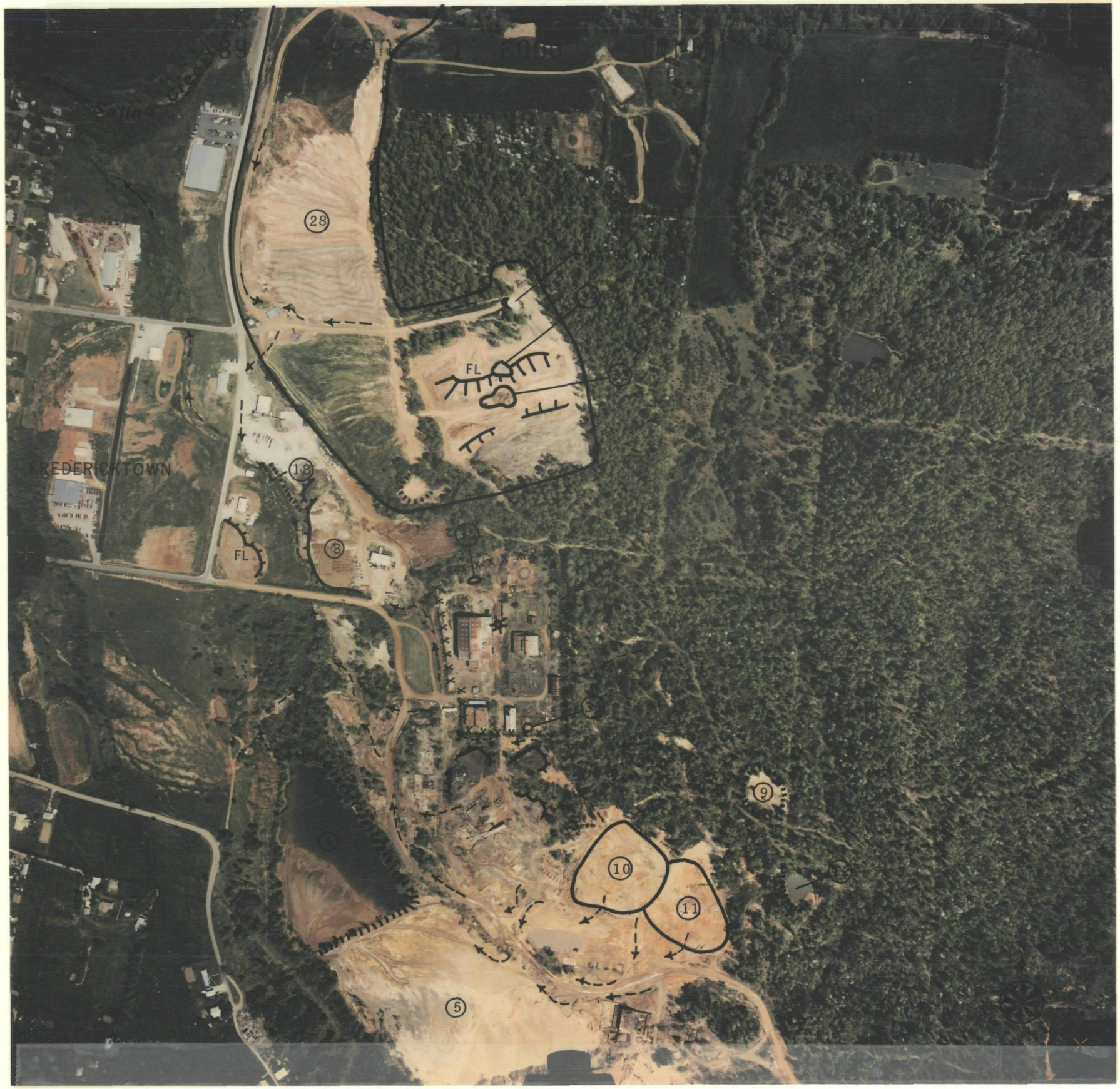
- FL FILL
- IM IMPOUNDMENT
- LG LAGOON
- OF OUTFALL
- SD SLUDGE
- ST STAIN
- SW SOLID WASTE
- TR TRENCH
- VS VEGETATION STRESS
- WD WASTE DISPOSAL AREA
- WL WETLAND

Figure 9. Madison Mine, April 18, 1984. Approximate scale 1:20,900.

MAY 2, 1989 (FIGURES 10, 11, AND 12)

No significant changes were observed at the tailings pond (Annotation 4), tailings (Annotation 5) or the ponds located at Annotations 9 and 12 since the photo coverage of April 18, 1984 (Figure 9). The trenches previously located in Annotation 28 have been filled and the south portion of the area revegetated. The hillside east of the revegetation has been cleared and there is a backhoe and dozer digging a pit in the excavation at Annotation 33. Debris has been dumped on top of the fill at Annotation 34. Annotation 18 is the previous location of an impoundment. There is white sediment in the cut that has been made through the containment wall and in the intermittent stream leading north to Saline Creek. The impoundment is partially filled with sand and fill dirt. Annotation 8 is the previous location of an impoundment that has been completely filled. Annotations 35 and 36 show the locations of two newly excavated pits. The containment walls of the ponds previously located at Annotations 10 and 11 have been removed and there are numerous small rills and gullies passing through this area and leading toward the intermittent stream.

There is no significant change noted at the tailings located at Annotation 6 which displays extensive erosion along its northern face and along the southern portion leading into the tailings at Annotation 13. There are five areas around the perimeter of the tailings of Annotation 13 where fill material has been dumped and has now revegetated. The three holding ponds (Annotations 30, 31, and 32) located along the drainage ditch on the eastern side of the facility all contain a greenish colored murky liquid.



INTERPRETATION CODE

BOUNDARIES AND LIMITS

- FENCED SITE BOUNDARY
- UNFENCED SITE BOUNDARY
- FENCE
- STUDY AREA

DRAINAGE

- DRAINAGE
- FLOW DIRECTION
- INDETERMINATE DRAINAGE

TRANSPORTATION/UTILITY

- VEHICLE ACCESS
- RAILWAY

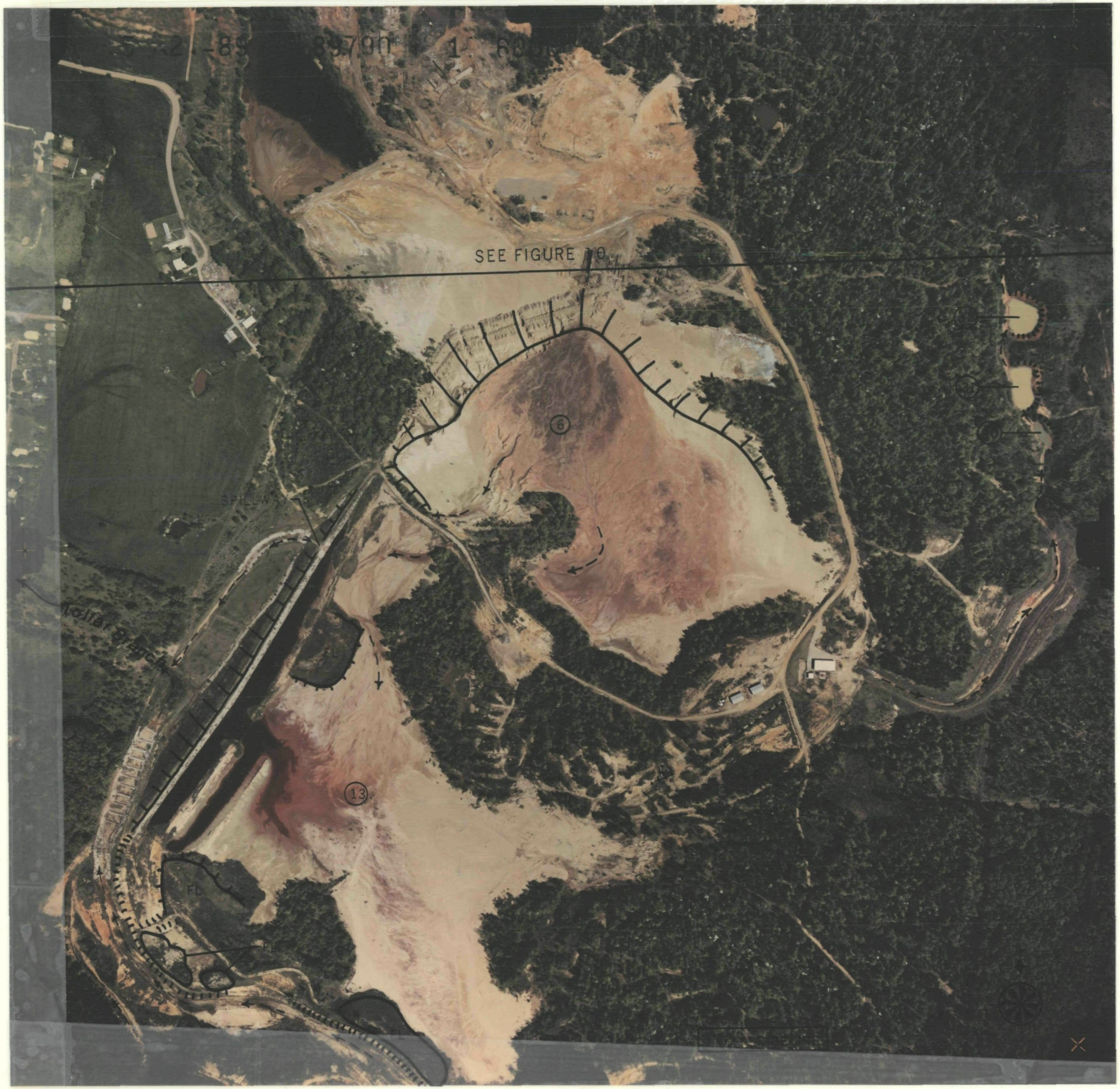
SITE FEATURES

- DIKE
- STANDING LIQUID
- SL — STANDING LIQUID
- EXCAVATION, PIT (EXTENSIVE)
- MOUNDED MATERIAL (EXTENSIVE)
- MM — MOUNDED MATERIAL (SMALL)

- CR — CRATES/BOXES
- DR — DRUMS
- HT — HORIZONTAL TANK
- PT — PRESSURE TANK
- VT — VERTICAL TANK

- CA — CLEARED AREA
- DG — DISTURBED GROUND
- FL — FILL
- IM — IMPOUNDMENT
- LG — LAGOON
- OF — OUTFALL
- SD — SLUDGE
- ST — STAIN
- SW — SOLID WASTE
- TR — TRENCH
- VS — VEGETATION STRESS
- WD — WASTE DISPOSAL AREA
- WL — WETLAND

Figure 10. Madison Mine, May 2, 1989. Approximate scale 1:6,000.



INTERPRETATION CODE

BOUNDARIES AND LIMITS

- FENCED SITE BOUNDARY
- UNFENCED SITE BOUNDARY
- FENCE
- STUDY AREA

DRAINAGE

- DRAINAGE
- FLOW DIRECTION
- INDETERMINATE DRAINAGE

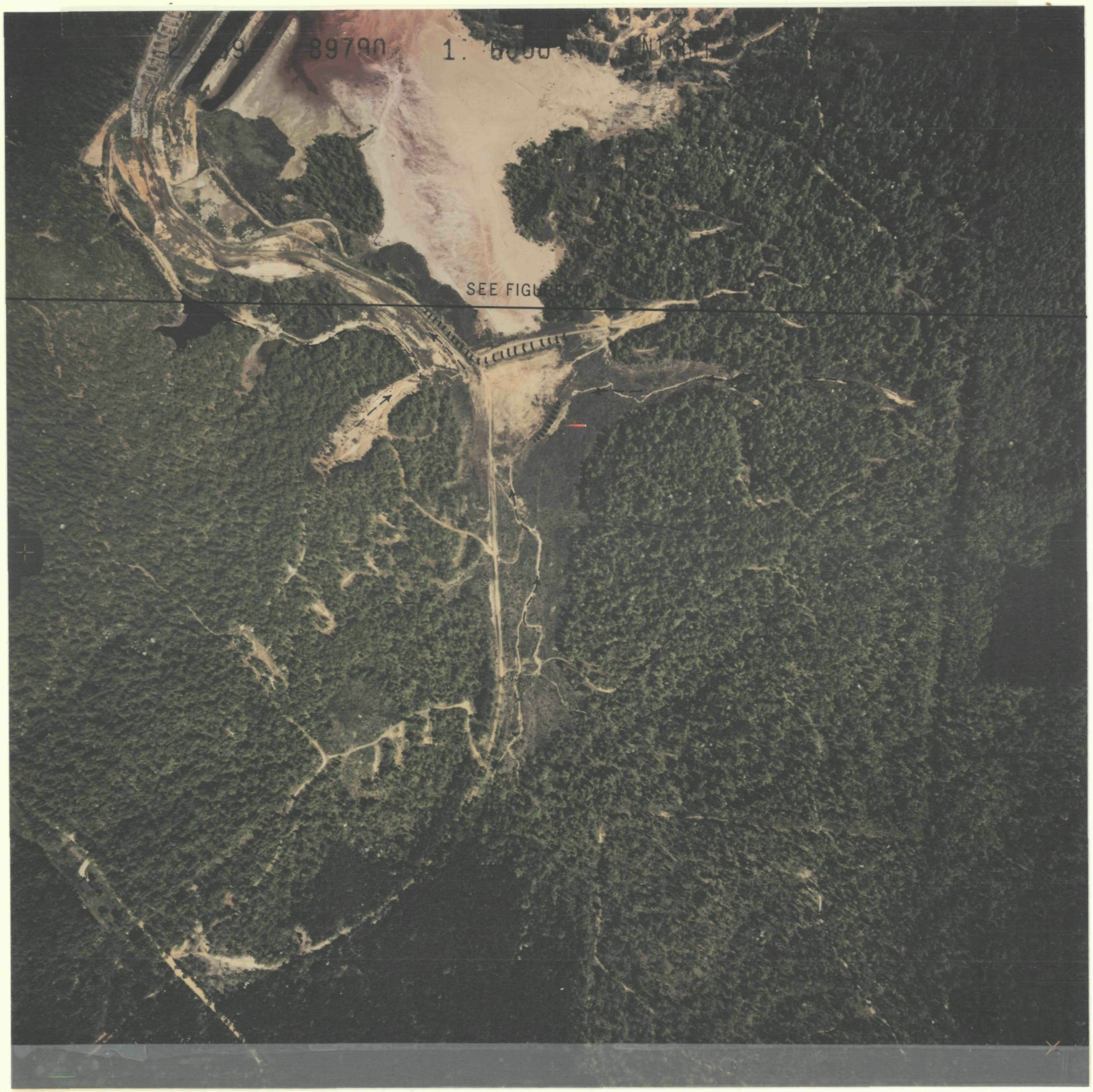
TRANSPORTATION/UTILITY

- VEHICLE ACCESS
- RAILWAY

SITE FEATURES

- DIKE
- STANDING LIQUID
- SL — STANDING LIQUID
- EXCAVATION, PIT (EXTENSIVE)
- MOUNDED MATERIAL (EXTENSIVE)
- MM — MOUNDED MATERIAL (SMALL)
- CR — CRATES/BOXES
- DR — DRUMS
- HT — HORIZONTAL TANK
- PT — PRESSURE TANK
- VT — VERTICAL TANK
- CA — CLEARED AREA
- DG — DISTURBED GROUND
- FL — FILL
- IM — IMPOUNDMENT
- LG — LAGOON
- OF — OUTFALL
- SD — SLUDGE
- ST — STAIN
- SW — SOLID WASTE
- TR — TRENCH
- VS — VEGETATION STRESS
- WD — WASTE DISPOSAL AREA
- WL — WETLAND

Figure 11. Madison Mine, May 2, 1989. Approximate scale 1:6,000.



INTERPRETATION CODE

BOUNDARIES AND LIMITS

- FENCED SITE BOUNDARY
- UNFENCED SITE BOUNDARY
- FENCE
- STUDY AREA

DRAINAGE

- DRAINAGE
- FLOW DIRECTION
- INDETERMINATE DRAINAGE

TRANSPORTATION/UTILITY

- VEHICLE ACCESS
- RAILWAY

SITE FEATURES

- DIKE
- STANDING LIQUID
- SL STANDING LIQUID
- EXCAVATION, PIT (EXTENSIVE)
- MOUNDED MATERIAL (EXTENSIVE)
- MM MOUNDED MATERIAL (SMALL)
- CR CRATES/BOXES
- DR DRUMS
- HT HORIZONTAL TANK
- PT PRESSURE TANK
- VT VERTICAL TANK
- CA CLEARED AREA
- DG DISTURBED GROUND
- FL FILL
- IM IMPOUNDMENT
- LG LAGOON
- OF OUTFALL
- SD SLUDGE
- ST STAIN
- SW SOLID WASTE
- TR TRENCH
- VS VEGETATION STRESS
- WD WASTE DISPOSAL AREA
- WL WETLAND

Figure 12. Madison Mine, May 2, 1989. Approximate scale 1:6,000.